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ABSTRACT

This paper presents (1) data indicating the need to increase the percentage of higher cognitive questions in the instructional program, based upon research showing that questioning strategies are instrumental in improving comprehension; (2) data indicating that questions currently included in instructional programs are predominantly of the lower cognitive level; (3) sources of information for constructing higher cognitive questions and questioning strategies and for evaluating answers to comprehension questions in reading, listening, and the content areas; and (4) suggestions about how comprehension can be improved by creating or revising educational materials to include higher cognitive questions for all grades and in all curricular areas. (Author/AA)

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ABSTRACT

The purpose of this paper is to present (1) data indicating the need to increase the percentage of higher cognitive questions in the instructional program based upon research evidence showing that questions and questioning strategies are instrumental in improving comprehension; (2) data indicating that questions currently included in instructional programs are predominately of the lower cognitive level; (3) sources of information for constructing higher cognitive questions, questioning strategies, and evaluating answers to comprehension questions in reading, listening, and in the various content areas; and (4) suggestions through which comprehension can be improved by the preparation of educational materials and the improvisation of existent materials to include higher cognitive questions for all grades and in all curricular areas.

CS003 559

Are you improving comprehension?

That is a good question to ask yourself. Whether you can answer this question in a positive manner will depend upon your knowledge of the cognitive levels of comprehension questions, questioning strategies, and their application in the instructional program.

What is the relationship between improved comprehension and the cognitive levels of questions and questioning strategies?

Research has shown that comprehension is directly related to the cognitive levels of questions and to their sequencing. Piaget (10) views cognitive development occurring as the learner interacts with the environment and organizes experiences encountered in the environment. Questions are important in the organization of experiences in the learning process.

Taba (16), basing research upon Piaget, found that through comprehension questions of lower and higher cognitive levels and questioning strategies providing for the transition from one level of thought to another, children were able to function at higher cognitive levels of comprehension.

Smith (14), analyzing the length of the grammatical structures used by children in answers to questions of two cognitive levels, showed that higher cognitive questions resulted in answers that were significantly longer in

the number of words than were the answers to the questions asked at the lower cognitive level. This research data indicates that the thought processes involved in the answers to comprehension questions are related to the cognitive level of the questions. Higher cognitive questions result in answers which reflect the use of higher cognitive processes than do questions at the lower cognitive level.

What are the cognitive levels of comprehension questions?

Questions have been categorized into various taxonomies ranging from two to seven levels. For research purposes questions have been analyzed in two major categories, lower and higher cognitive levels. At the lower cognitive level, Ruddell (12) cites the factual question, and Lowery (9), the narrow question. At the higher cognitive level Ruddell combines the interpretive and applicative questions and Lowery cites the broad question.

At the lower cognitive level the questions and answers are concerned with experience, recall of immediate information, and correct answers with planned convergent outcomes. Examples of lower cognitive questions are: (1) Who is in the story? (2) What is the name of the main character? and (3) Have you heard this story before?

At the higher cognitive level the questions and answers relate to the modification of the content by analysis, reconstruction, or inference of relationship. The answers may also involve creative problem solving using divergent

outcomes with different acceptable responses. Examples of higher cognitive questions are: (1) Why do you suppose the story ended as it did? (2) What is happening in the picture? and (3) Evaporation is a new word. What do you think evaporation means?

What are questioning strategies?

Improving comprehension involves more than the asking of questions at the various cognitive levels. Taba (16) explains that cognitive development is related to the developmental level of the learner. Cognitive development follows a sequence in which simpler and more concrete information precedes and prepares the learner for more complex and abstract knowledge. Learning consists of a series of sequential steps in which successful mastery of each step is a prerequisite for the progression on to the next step. Questioning strategies sequencing comprehension questions of the various levels provide for the progression of learning from the lower to the higher cognitive levels.

Questioning strategies are the planned sequences of questions. Questions usually occur in a series. The questioning process begins with a focusing question. This question focuses upon the topic to be discussed and causes the learner to call forth previous knowledge to be related with the topic of the question. The focusing question can be at either a lower or higher level depending upon the previous expreiences of the learner. An example of a

focusing question at a lower cognitive level is, "What do you see in the picture?" The focusing question may be at a higher cognitive level by changing the wording of the previous question: "What is interesting about this picture?"

The answers to the focusing question provide information indicating whether the learners have or do not have the needed information to pursue the topic further. Other questions about the topic may be asked at the same cognitive level as the one previously asked. These questions which extend the cognitive level of the questioning process are referred to as extending questions. Further information can be gained by extending the questioning on the same cognitive level to make certain that the expected information is available to the learners for the answering of the questions that follow.

When information is desired at a higher cognitive level a raising question is asked. Raising questions provide the opportunity for the learners to associate past knowledge with that which is called for by the question, and thus to develop thoughts that are new for the learners. The higher cognitive questions provide for the assimilation of data and prepare the learners for further insights on the same or related topics.

The questioning strategy continues as focusing, extending, and raising comprehension questions are asked. The following provides a brief example of a questioning strategy:

Focusing Question - Factual Level

What is this book about?

Extending question - Factual Level

What do you know about magnets?

Raising Question - Interpretive Level

What is expecially interesting about this picture?

Extending Question - Interpretive Level

Why do you suppose these objects are in two piles?

Focusing Question - Factual Level

What is this object made of?

What cognitive levels of questions are most frequently asked in the instructional program?

Although improved comprehension has been related to the cognitive levels of instructional questions, research data indicates that the majority of questions used by instructors are at the lower cognitive level (5, 6, 12, 15). Guszak (6) found that the questions teachers asked about reading were about 70 percent at the literal comprehension level. Ruddell and Williams (12) found that teachers used twice as many factual as interpretive questions. Of greater importance is the fact that in reply to questions, children based their answers upon factual information about 86 percent of the time (12). Gall (5) concludes from an investigation of research spanning more than a half-century that teachers' questions emphasize factual information about three-fourths of the time while one-fourth require students to think.

Why are lower cognitive questions predominate in the instructional programs?

There is little wonder why teachers ask lower cognitive questions. All one needs to do is to examine the instructional materials, teachers' manuals or other instructional guides in reading and in all content areas of the curriculum and calculate the percentage of lower cognitive questions. Teachers ask questions at the same level as those they encounter in the instructional materials prepared for their use in teaching. The questions in most instructional guides and materials have been predominately factual. Often no questions at all are included to guide instruction.

Ruddell (11) points out the fact that in the past there has been little opportunity for educators to develop competence in understanding and using questioning strategies at the preservice or inservice level. Gall (5) emphasizes the need for professional programs designed to develop effective questioning strategies and techniques. In order to improve comprehension educators must learn how to design and to ask a greater percentage of higher cognitive questions, to use questioning strategies appropriately, and to learn how to evaluate the effectiveness of questions to promote answers indicative of the use of higher cognitive processes.

How can educators become more effective questioners?

Guidelines are presently available to assist educators

in the construction and evaluation of comprehension questions and in the designing of questioning strategies. Reading-Language Instruction: Innovative Practices, by Ruddell (11) presents numerous examples of questions of three cognitive levels that can be asked in the teaching of reading and listening, as well as examples of questioning strategies.

Learning About Instruction: Questioning Strategies 1, by Lowery (9), a self-directed guide for designing questions in all instructional areas, focuses upon teacher initiated questioning strategies and the relationship of the strategies to students' thinking.

Two in-depth minicourses in effective questioning have been developed by Far West Laboratory for Educational Research and Development (3, 4). Both Minicourse 1: Effective Questioning Elementary Level (3) and Minicourse 9: Higher Cognitive Questioning (4) are designed to increase teacher effectiveness in structuring questions and improving discussion skills through the use of questions that require longer pupil responses indicative of the use of higher cognitive processes. Minicourse 1 is designed for the primary grades and Minicourse 9 for grades four through nine.

Resourceful publications devoted entirely to question construction include: (1) Classroom Questions: What Kinds? by Sanders (13); and the two recent books by Hunkins, Questioning Strategies and Techniques (7), and Involving

Students in Questioning (8). Both Sanders and Hunkins have based their levels of questions in part upon the Taxonomy of Educational Objectives by Bloom (1). These publications assist educators in formulating questions for all grades and subjects from elementary through college.

Smith (14) presents a method of evaluating answers to comprehension questions. The effectiveness of comprehension questions in stimulating higher cognitive processes can be determined by calculating the number of words in the communication units, a measure of linguistic and cognitive growth, used in the answers to questions. The communication unit, developed by Loban (8), is a linguistic unit that cannot be further divided without loss of its meaning. It consists of a grammatically independent clause with any of its modifiers. The sentence, "I see a girl with a boy," consists of one communication unit. The meaning would be lost if the sentence were segmented into smaller units. The sentence, "I see a girl and I see a boy," consists of two communication units, "I see a girl," and "and I see a boy." However, the sentence, "I see a girl and a boy," consists of only one communication unit.

The following are examples of questions, answers, and communication unit lengths:

Lower Level Question: What did the little girl find in the woods?

Answer to Question: a gunniwolf/

The communication unit length for this answer consists of two words.

Higher Level Question: What does the gunniwolf remind you of?

Answer to Question: he looks like a real mad wolf that's going to eat something up/

The communication unit length for this answer consists of fourteen words. The contraction, "that's," is counted as being two words.

Although the research by Smith (14) evaluating the answers to comprehension questions showed that the answers to higher level questions were significantly longer than were the answers to lower level questions as measured by the average words per communication unit length, not all questions categorized as higher cognitive level questions are consistent in eliciting higher cognitive answers. For example, in answer to the higher cognitive valuing question, "How would you feel?" the brief reply might be, "bad," "glad," "sad," or "happy." In order to determine the effectiveness of each specific question in eliciting the expected cognitive level responses, it is necessary to calculate the number of words used in the answers to each question. Questions which do not elicit answers at the anticipated cognitive level for which they are designed can be changed to elicit longer answers. For instance, the question pertaining to personal feelings can be altered to elicit a higher cognitive level answer by asking for a clarification of the answer, "Why would you feel (bad. glad, sad, happy)?"

When should comprehension questions and strategies be constructed?

Most educators are not prepared to guide instruction and at the same time create questions and strategies. Therefore, questions and questioning strategies should be designed and evaluated before they are implemented in the instructional programs. It is not adequate to merely design questions and strategies for instructional guides. Before being included in instructional guides the questions should be tried out in actual learning environments with subjects of similar background as the ones for whom the questions have been constructed in order to determine the effectiveness of the questions to elicit answers of the anticipated communication unit lengths for which they were designed. By evaluating the questions before they are part of the instructional guides, those questions which do not fulfill the expected requirements can be modified or even eliminated from the instructional guides. Although questions and strategies will be designed and evaluated prior to instruction, they will need to undergo further modification during actual use in the instructional program so that the specific requirements of each individual learner can be met.

The questions included in the instructional guides should be put into the question form rather than be suggestions for questions such as, "Have the student tell about

the picture." This will assure that the questions will be asked by the instructor at the appropriate cognitive levels.

The anticipated answers should also be included to accompany the questions to provide the instructor with immediate data upon which to judge the correctness or appropriateness of the answer and the cognitive level as determined by the communication unit length used in the answer.

Together with the questions, strategies, and anticipated answers, suggested instructor-learning interaction patterns should be included. Questioning strategies may be designed for use with individuals or groups of learners. For each instructional situation suggestions should be included to provide for the maximum number of learners to participate by formulating answers to the questions. Improved comprehension is related to increased participation by each learner in answering each comprehension question. Ideally each learner should be given the opportunity to answer each question so as to assure maximum comprehension from each instructional period. Although it may not be possible for all the answers to be verbalized or written by everyone, it is most important that each learner be given the opportunity to form thoughts about each comprehension question before the question is answered by another member of the group. The larger the number of questions answered by each learner, the greater

the amount of thoughts formulated, the more improved will be comprehension.

For what areas of instruction can comprehension be improved?

Higher cognitive questions and questioning strategies can improve comprehension in every area of knowledge. Ruddell (11) lists numerous examples of questions to accompany reading and listening instruction which include (1) prestory questions on the picture, title and author; (2) questions during the reading about the picture, the characters and the plot; and (3) post story questions on the characters, the plot, the story, and the author.

Questions could be designed to accompany every story to guide comprehension whether the stories are from basal reading texts, or other sources. The questions could be prepared in separate booklets or typed on cards and placed in a card pocket or attached to the inside covers of the books. All books could become valuable sources of information for improving comprehension by the preparation of appropriate questions to accompany them.

Comprehension can be improved in all subject or content areas through the designing of questions and questioning strategies to accompany the instructional materials. Although the questioning process will be similar in some ways, each area of knowledge is somewhat unique. Questions about each subject will differ according to the body of

knowledge and the organization of thought. The meanings of words peculiar to each subject can be developed for the learners through appropriate questions. In literature, questions will be concerned with interpretation of figurative language. Questions in mathematics will deal with specific information critical to problem solving. In art, drama, and music, the questions will be concerned with aesthetic judgments. Science questions will be concerned with details, exactness, and cause and effect relations. Problem solving in social science, unlike mathematics and science, will have no one correct answer.

Often the textbooks in the content areas are deterrents to questioning at higher cognitive levels because the data is presented in an orderly manner with all the complex ideas explained for the learners. The interpreting of information has already been done by the author and the learner is presented with information to be remembered. Questioning in the content areas can be developed upon the various medias to supplement the textbooks. Questions and questioning strategies should be developed to accompany films, filmstrips, recordings, videotapes, television, radio, lectures, demonstrations, drama, musical and dance performance, pictorial representations, models, works of art, and so forth. We seldom find instructional guides to accompany information presented through the various medias for gaining knowledge. Comprehension questions can relate the knowledge the learner

has gained from the various sources with the textbook presentation. The textbooks can then be used as sources to review and reinforce learning and to organize the data derived from the various sources.

Will you improve comprehension?

The use of higher cognitive questions and questioning strategies will alter your role from that of being a giver of information to that of being a guide in the heuristic or discovery approach to learning. Socrates, one of the greatest teachers of all times, guided learning through a clever sequence of questions by which he led the learner to discover knowledge. The questions provided the means through which the learner applied information that was already a part of past experiences with that information which was called forth during the questioning process. Through the process of questioning your role as instructor will be transformed. Likewise the role of the learner will be altered from the passive role to that of being an active participant in learning.

Improved comprehension should be a concern of each educator. You can begin improving comprehension by (1) learning more about higher cognitive questions, questioning strategies, and the evaluation of answers to questions; (2) instructing others to construct and evaluate questions and strategies; (3) preparing instructional materials that have appropriate questions, strategies, and answers for the questions;

(4) creating questioning strategies to accompany the numerous sources for transmitting information, the films, filmstrips, and so forth; and (5) using questioning strategies in your own instructional programs whether you are at the graduate, undergraduate, high school, or elementary level of instruction.

Now when you are asked, "Are you improving comprehension?" you can answer this question in a positive manner. You have learned about the cognitive levels of comprehension questions, questioning strategies, and the evaluation of the answers to questions. You have been provided with sources of information to assist you in constructing questions and questioning strategies; and you have been given suggestions for preparing and improvising educational materials in the various areas. The extent to which you improve comprehension, however, will depend upon your scope of influence in implementing these ideas in your instructional programs.

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